tends across the whole valley. Having climbed to the top of this huge pile of rather angular blocks, you suddenly discover a small lake between the moraine and the ice. The moraine, in part at least, is the barrier that holds back the water of the lake. Except at the outlet of the lake, this moraine rises above the present level of the ice, — in some places fifty feet or more, — and therefore must have been formed at a time when the ice stood at a much higher level than now. The lake is rather less than one hundred yards in diameter. It is locally known as the Frozen Lake, being covered by a weak, granular sort of ice even in midsummer. Floating on the surface of the lake were several blocks of quite solid ice from six to twenty feet long, and rising from two to twelve inches above the water. These little icebergs have evidently broken off from the thin edge of the glacier, which ends in a small cliff from one to three feet high.

The material of the ice-field, though somewhat granular on the surface, is not a mass of snow, but a clear and compact ice. This was determined by observation at the crevasses, and by cutting into it. The surface is deeply furrowed by rains and the water of the melting ice running down the slopes.

The principal crevasse is curved so as to be nearly parallel with the shore of the lakelet, and is not far from one hundred feet back from it. On the upper side of the crevasse the plane of fracture is nearly at right angles to the surface of the ice, but on the lower side the ice has been tilted over; so that, while the crevasse is about ten feet wide at the surface, it is very narrow at the bottom of the ice. The lower parts of the crevasses were filled with snow and broken icicles, ice stalagmites, etc., so that only from twenty to thirty feet can be seen. How much deeper the crevasses really are, is not known; but, from the size and shape of the ice-field, it does not seem probable that the greatest depth of ice exceeds fifty or seventy-five feet. Above the main crevasse were two others large enough to be seen through the recent snow. The number of crevasses is greatest north of the centre of the glacier, where there is a more direct exposure to the sun.

Standing at the lake, you see the glacier sloping steeply down toward you from the south, the west, and the north, somewhat like the seats in a theatre. This causes the ice at the north end of the glacier to flow south, while at the south end it is flowing in nearly the opposite direction. As a result of this peculiar shape, the glacier is somewhat wider than it is long; but it is not exactly symmetrical. On the north side of the valley the ice reaches about two hundred feet farther down the valley (eastward) than on the south side, and it has also extended a tongue of ice southward across the outlet of the lake, so that the outlet is by a subglacial channel. This tongue of ice is nearly one hundred feet wide, and rises six or eight feet above the lake. Some interesting questions suggest themselves as to the cause of the ice having receded farther on the shady side of the valley, the effects of different exposures to the sun, the relative protection afforded by different-sized moraines, inequality of snowfall on the opposite sides of the valley, etc. The depth of recent snow made it impossible to properly examine beneath the edges of the moraines to determine if there is beneath them any ancient and now quiescent ice. Omitting these more complicated questions, it seems probable that the extension of that tongue of ice across the outlet of the lake is, partly at least, caused by a more rapid rate of flow of the ice on the north side of the valley, where there is a more direct exposure of the sun. The slopes of the ice are everywhere steep. In places they would be considered steep for the roof of a house.

It was of special importance to determine if moraines are now being deposited. I saw no evident moraines and only two small pieces of rock on the ice anywhere. The cliffs around the head of the glacier are nowhere very high, in places rising only a few feet above the ice, and they are surprisingly bare of loose fragments. It is just as if the greater glacier of the past had removed all loose material, and the process of weathering has not yet had time to split up the rock and furnish fresh *débris*. Some of the bowlders in the lake come near the surface, and may be a recent terminal moraine. Perhaps a careful examination when the ice is bare of recent snow may reveal moraines now forming; but, if so, they must be small, since there is so little moraine-stuff being cast upon the ice.

There are several other 'snow-fields' in the vicinity of Long's Peak which show some signs of glacial flow. Stakes ought to be set on the surface of these ice masses (for they are all ice rather than snow), and their motions accurately observed.

The view from Hague's Peak is one of the finest in the Colorado Mountains. A trip to this mountain and its small but interesting glacier will rank well with the ascent of Pike's, Gray's, or Long's Peaks. The height of Hague's Peak, as given by Hayden, is 13,832 feet, only 439 feet lower than Long's Peak. The glacier is approximately in north latitude 40° 28′.

From the name of the discoverer, this is known as the Hallett Glacier. G. H. STONE.

Colorado Springs, Sept. 13.

## Condensed Milk.

A CURSORY examination of several cans of preserved milk, that were offered for sale in this State at a price below the actual cost of manufacture, revealed the fact that much of this milk was of poor quality, while some was unfit for use; hence, in the early part of this year, a thorough investigation was made of all the brands of canned milk on sale, and samples were sent to Prof. H. B. Cornwall, of the John C. Green School of Science, Princeton, for analysis. His report, here printed, is of sufficient importance to warrant its publication in advance of my annual report to the Legislature.

WM. K. NEWTON.

Office of the Dairy Commissioner of New Jersey,
Paterson, N.J., Sept. 17.

DURING the first five months of this year a number of samples of condensed milk were received from the State dairy commissioner, and analyzed by the writer, with the result stated in this paper. All but two were condensed with the addition of cane-sugar. While the milks condensed without sugar may be better for infants and invalids if not kept long in cans, yet they are not certain to remain sound, even in the sealed cans, for any length of time, and are therefore of doubtful value.

The milks preserved with cane-sugar, on the other hand, if carefully prepared, keep well in cans, and do not spoil very rapidly even after the cans are opened, provided the can is kept in a dry place and no water is mixed with it. For use with tea and coffee, and for making puddings, custards, etc., they are an excellent substitute for fresh milk.

The very large amount of cane-sugar necessary to preserve them renders them, however, an unwholesome food for infants, and they can by no means be regarded as a good substitute for fresh milk in this case.

The directions on the cans in general state, that, by adding a certain quantity of water, the condensed milk can be made to resemble cream; by adding more, it becomes the equivalent of milk. This can never be true: cream contains from three to four times as much fat as the average condensed milk, and no dilution with water will make such milk resemble cream except outwardly. It would be well if all makers would follow the course pursued by a few, and, while giving such directions as are necessary in using the milk for making desserts, etc., recommend that the advice of a physician be obtained as to the diet of infants. Condensed milk preserved with sugar can never be a fit food for infants.

In some instances very misleading statements as to the quantity of fresh milk condensed to produce the contents of the preserved milk cans were made. It will be seen that the condensation is very rarely more than threefold, and usually somewhat less.

A well-made condensed milk, with cane-sugar, should show very little if any undissolved sugar, and should be of a nearly white color, having but a faint yellowish tinge. It should have no cheesy taste or smell, and should dissolve readily in about four parts of cold water. Especially should it dissolve without showing separated flocculent particles of caseine or curds.

### METHOD OF ANALYSIS.

To insure thorough mixing, the entire contents of the can were emptied into a porcelain vessel and thoroughly stirred; 40 grams of the milk were weighed out and diluted with water to 100 cubic centimetres, so that 5 cubic centimetres of the diluted milk corresponded to 2 grams of the condensed milk.

In the case of sample No. 33, which curdled even when slightly warmed with water, and would not mix well with cold water, the portions needed for each determination were separately weighed out.

*Total Solids.* — Of the diluted milk a measured volume was diluted again with an equal volume of water, so that 5 cubic centimetres corresponded to 1 gram of the condensed milk, and then 5 cubic centimetres were dried in a flat-bottomed platinum dish (40 millimetres in diameter at the bottom), at first on the water-bath, then in an air-bath at 100° to 105° C., until the loss of weight after drying half an hour was less than 2 milligrams. Comparative experiments showed that under the above conditions the drying was as thorough as if the milk had been first coagulated with acetic acid, while the method was more convenient. At first 2 grams of milk were used, but the result was the same, while the drying was far more tedious.

Duplicate determinations were made. The greatest difference was 0.29 per cent; usually it was much less; occasionally the results were identical.

*Ash.* — The dried milk was ignited in the same dish at a scarcely visible red heat, until no black carbonaceous portions were left. In one case the chlorine in the ash was determined by Volhard's volumetric method, and found to be 9.52 per cent.

*Fat.* — Rather thick white filter-paper was thoroughly extracted with ether in a Soxhlet apparatus, and 5 cubic centimetres of the diluted milk (equal to 2 grams of the condensed milk) dropped on a nearly square strip of this paper large enough to conveniently soak up the milk. To avoid the formation of candied spots, the milk was uniformly spread over the paper by brushing with a small, narrow strip of the same sort of paper. After drying in the air, the paper was rolled to a loose cylinder, and dried in an air-bath at 100° C. for about an hour and a half. The fat was then extracted with ether for two hours in a Soxhlet apparatus; and a second extraction was made, lasting from an hour to an hour and a half longer. The second extraction usually yielded less than 4 milligrams more of fat, and often none at all. The fat determination was made in duplicate. The greatest difference was 0.2 per cent; usually only a few hundredths of a per cent.

At first, extraction after drying with sand was employed, but comparative tests showed that the paper method yielded better results in less than half the time.

It is a very difficult matter to extract all of the fat from a dried condensed-milk residue in any other way than by using paper, essentially Adams's method. Blotting-paper would not be as good as the thinner filter-paper, because there is so much cane-sugar present in some of the milks.

*Caseine and Albumen.* — Ritthausen's method was followed, essentially as described by Dietzsch (*Nährungsmittel und Getränke*, Zurich, 1884); 5 cubic centimetres of the diluted milk, equal to 2 grams of the condensed milk, being further diluted with water to 40 cubic centimetres, and then treated with enough of a solution of copper sulphate (6.35 grams in 100 cubic centimetres of water) to insure quick separation of the coagulated albumen after stirring, 15 drops being added in almost every case. Then enough of a 5-per-cent solution of caustic potash was added to render the mixture nearly neutral to blue litmus-paper; an excess of the potash being avoided, as this would hold some of the caseine in solution and render the filtrate turbid. In most cases 5 drops was found to be a proper quantity. After settling clear, the fluid was decanted into a weighed filter 11 centimetres in diameter, previously dried at 100° C. The precipitate remaining in the beaker was stirred up with 20 to 30 cubic centimetres more of water, and finally the whole of the precipitate was brought on the filter, the washing being continued until 100 cubic centimetres of liquid had passed through the filter. This filtrate was preserved for the milk-sugar determination. The precipitate and filter were weighed together, after drying at 100° C., until the loss of weight after drying half an hour did not exceed 1 milligram. The filter and precipitate were next incinerated in a porcelain crucible, and the weight of the residue deducted from the weight of the dry precipitate: the difference was the weight of the albumen (including caseine) and fat; and after deducting the weight of the fat the percentage of the albumen (caseine) was calculated. S. W. Parr (*Amer. Chem. Journ.*, vii. p. 246) has shown that the results by Ritthausen's method are "nearly, if not quite correct." It is probably the best method for condensed-milk analysis.

*Milk-Sugar.* — This was determined in most cases by treating 25 cubic centimetres of the filtrate just mentioned with 15 cubic centimetres of Fehling's solution (68 grams of caustic soda and 187 grams of tartrate of potassium and sodium in 500 cubic centimetres of water; 34.64 grams of copper sulphate in 500 of water; the two solutions being mixed at the time of using them combined as Fehling's solution) in a porcelain dish resting on wire gauze over a Bunsen burner. The contents of the dish were rapidly brought to boiling, and then boiled for four minutes, after which the liquid was filtered through a filter 6 centimetres in diameter, and the precipitated suboxide of copper was washed, chiefly by decantation in the dish, with about 40 cubic centimetres of water, which was also passed through the filter. As little of the precipitate as possible was brought on the filter. The filter was then dried and burned, the residue dissolved in a little nitric acid, this acid poured into the dish to dissolve the suboxide of copper, and the solution evaporated with a little sulphuric acid until all nitrous fumes were expelled. The solution was then diluted with water and the copper deposited electrolytically in a small platinum dish. Rodewald and Tollens (*Berichte*, xi. 2076) have shown, that, when milk-sugar is treated with Fehling's solution as above described, the weight of copper multiplied by 0.763 equals the weight of milk-sugar present. They worked with asbestos filters, and certainly the paper filter does retain a very little of the copper in the Fehling's solution; but a blank test showed that the filter used in these examinations of condensed milk retained only 0.0009 of a gram of copper; so that the above factor, 0.763, was used in calculating the results.

*Cane-Sugar* was obtained in every instance by deducting the weight of the remaining solids (milk solids) from the total solid residue of the dried milk.

GENERAL OBSERVATIONS.

The following tables, I. and II., give the results of analysis of the milks according to the method just described. The last column, headed 'Times condensed,' indicates the number of volumes of the original milk that were condensed to one volume. The figures in this column are obtained by dividing the figures representing the percentage of milk solids by 12.5, which is assumed as the average percentage of solids in the original milks. Hehner (*Analyst*, iv. p. 44) has calculated the condensation by dividing the percentage of milk solids not fat by 9.3, the assumed percentage of such solids in cow's milk. The figures thus obtained would differ in the case of our samples by less than 0.2 per cent in any instance. The percentage of fat in the original milk is naturally obtained by dividing the figures representing the percentage of fat in the condensed milk by those representing the condensation. Although No. 21 cannot be regarded as made from a milk originally very rich in fat, yet there is nothing to indicate that any of the samples were made from skimmed milk.

A word or two seems proper with reference to the proportions of fat and caseine. The average percentage of caseine in cow's milk is variously given by different authorities, but is probably about 0.4 per cent greater than that of fat, as the writer has calculated from figures representing a very large number of analyses given in the 'First Report of the New York State Dairy Commissioner,' p. 58. It was stated, moreover, by Wigner (*Analyst*, iv. p. 48) that some of the caseine was decomposed during the condensation of milk with sugar, and it would therefore seem that the percentage of caseine in average condensed milk should at all events not greatly exceed that of the fat. In the writer's analyses it falls slightly below. The caseine and albumen reported in many of the analyses quoted in the New York dairy commissioner's second report, pp. 152–154, are very largely in excess of the fat; exceeding it, for instance, in four out of many cases by the following figures respectively: 8.1, 6.07, 8.24, 7.72 per cent.

There seems to be but one explanation of such a result, and that is, that the condensed milks were made from partially skimmed milk, without regard to the fact that the percentage of fat actually present in the condensed milk may not be below the average.

Hehner (*loc. cit.*) found two samples of a certain brand of con-

densed milk with 11.73 and 11.34 per cent of caseine and 7.19 and 6.98 of fat, respectively, and calculated that they were made from milks containing originally 2.5 per cent of fat; but he hesitated to call them skimmed. Judged by the above standard, they give certain indications of being skimmed.

Hassall's analyses of condensed milk cited by Hehner show in general greater condensation than those in this paper, but the average percentage of caseine is 16.85; of fat, 10.27; and here, again, skimming is certainly to be suspected.

TABLE I.

*Condensed Milk with Cane-Sugar.*

| No. of Sample. | Percentages. | | | | | | | | Times condensed. |
|---|---|---|---|---|---|---|---|---|---|
| | Water. | Fat. | Caseine and Albumen. | Milk-Sugar. | Ash. | Cane-Sugar. | Milk Solids. | Fat in Original Milk. | |
| 20 | 28.75 | 8.90 | 8.71 | 11.08 | 1.62 | 40.94 | 30.31 | 3.67 | 2.42 |
| 21 | 25.83 | 8.25 | 10.40 | 13.63 | 2.01 | 39.88 | 34.29 | 3.01 | 2.74 |
| 26 | 25.91 | 9.14 | 9.17 | 13.09 | 1.86 | 40.83 | 33.26 | 3.43 | 2.66 |
| 27 | 31.45 | 8.78 | 8.21 | 11.43 | 1.70 | 38.43 | 30.12 | 3.64 | 2.41 |
| 28 | 23.91 | 8.94 | 9.45 | 12.60 | 1.85 | 43.25 | 32.84 | 3.41 | 2.62 |
| 29 | 27.17 | 9.22 | 8.22 | 11.98 | 1.77 | 41.64 | 31.19 | 3.70 | 2.49 |
| 30 | 25.00 | 9.88 | 8.92 | 12.58 | 1.85 | 41.77 | 33.23 | 3.71 | 2.66 |
| 32 | 25.49 | 8.89 | 9.51 | 13.05 | 1.97 | 41.09 | 33.42 | 3.33 | 2.67 |
| 33 | 28.70 | 10.22 | 8.52 | 16.74 | 1.81 | 34.01 | 37.29 | 3.43 | 2.98 |
| 35 | 28.77 | 11.06 | 7.97 | 15.53 | 2.40 | 34.27 | 36.96 | 3.74 | 2.95 |
| 36 | 27.44 | 9.66 | 9.24 | 35.17* | 1.82 | 16.67 | - | - | - |
| 37 | 29.83 | 11.17 | 10.07 | 15.44 | 2.31 | 31.18 | 38.99 | 3.59 | 3.11 |
| 38 | 23.45 | 11.14 | 12.20 | 13.78 | 1.99 | 37.44 | 39.11 | 3.57 | 3.12 |
| 41 | 25.63 | 10.54 | 8.89 | 13.06 | 1.89 | 39.99 | 34.38 | 3.83 | 2.75 |
| Average.. | 26.95 | 9.69 | 9.25 | 13.38† | 1.92 | 38.82† | 34.26 | 3.54 | 2.74 |

* See 'Special Remarks,' below. † Excluding No. 36.

TABLE II.

*Condensed Milk without Cane-Sugar.*

| No. of Sample. | Percentages. | | | | | | | Times condensed. |
|---|---|---|---|---|---|---|---|---|
| | Water. | Fat. | Caseine and Albumen. | Milk-Sugar. | Ash. | Milk Solids. | Fat in Original Milk | |
| 34 | 63.25 | 10.72 | 10.08 | 13.79 | 2.16 | 36.75 | 3.64 | 2.94 |
| 40 | 64.09 | 9.35 | 11.75 | 12.68 | 2.13 | 35.91 | 3.25 | 2.87 |

The results given in the second New York report (*loc. cit.*) for condensed milk with sugar are as follows: —

| | Average. | Minimum. | Maximum. |
|---|---|---|---|
| Water | 25.43 | 15.45 | 30.08 |
| Caseine and Albumen | 12.15 | 8.20 | 18.96 |
| Fat | 10.78 | 5.96 | 17.01 |
| Milk-Sugar | 13.48 | 10.11 | 17.77 |
| Cane-Sugar | 35.89 | - | - |
| Ash | 2.27 | 1.62 | 3.62 |

The average amount of cane-sugar there given is lower than that in the milks analyzed by the writer, and the latter therefore contain, on the average, less milk solids, but among them are several milks of excellent quality. The percentages of fat and caseine are the most important, provided the milk be of good quality in other respects.

SPECIAL REMARKS.

The following details are of interest in connection with the analyses in Tables I. and II.: —

No. 21 was not in perfect condition; a little gas escaped on opening the can, and the milk was soon full of bubbles, caused by fermentation.

No. 27 contained a considerable amount of undissolved cane-sugar.

No. 33 was so stiff that it would not run out of the can, had a cheesy smell, curdled even when very slightly warmed with water, was of a brownish color, and altogether was of inferior quality.

No. 34 was apparently in good preservation, but the metal of the can was darkened inside, as if the tin had been attacked.

No. 36 was a dark brown, glutinous mass, with a smoky and cheesy taste and odor. Apparently molasses or glucose had been used in place of at least some cane-sugar in preparing it, as the result of the analysis indicates. The 35.17 per cent of 'milk-sugar' could not have been pure milk-sugar, and the figures really represent only a reducing power equivalent to that amount of milk-sugar.

No. 38 was quite stiff, of a brownish color, and had a somewhat cheesy smell.

No. 40 was not in perfect condition; the tin of the can was darkened inside, and gas escaped on opening the can. The caseine and albumen given in the table were calculated from the loss; an actual determination by Ritthausen's method gave 9.28 per cent of caseine.

The other milks, not especially mentioned above, were in good condition and well put up.

The percentage of ash of all of the milks, with the possible exception of No. 35, shows that the cane-sugar used was itself free from excessive ash.

H. B. CORNWALL.

Princeton, N.J., Sept. 14.

## Chalcedonized Fossils.

A CURIOUS instance of the formation of rose chalcedony on fossils was called to my attention some time ago. The fossils were mostly specimens of species of *Monticulipora*, and often the whole surface was covered with the ring-like chalcedonic formation. The cells of the coral were in most cases still plainly seen, but the whole outer aspect of the fossil was so changed as to make me think for a time that it might prove to be an undescribed species.

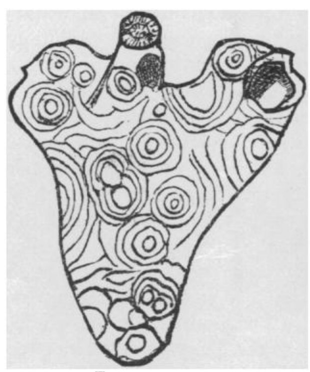

FIG. 1. × 2.

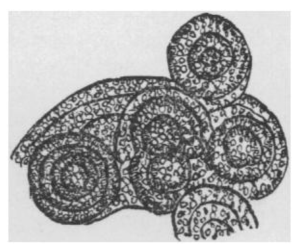

FIG. 2. × 4.

Fig. 1 shows the general appearance of one of the best specimens. Fig. 2 is an enlarged view of some of the rosettes. These corals are not the only ones having this peculiar feature, for certain specimens of *Streptelasma* present the same appearance. In many cases the rosettes are remarkably perfect, and in places the transition from the ordinary appearance to that of the chalcedonized surface is plainly seen.

JOSEPH F. JAMES.

Miami University, Oxford, O., Sept. 5.